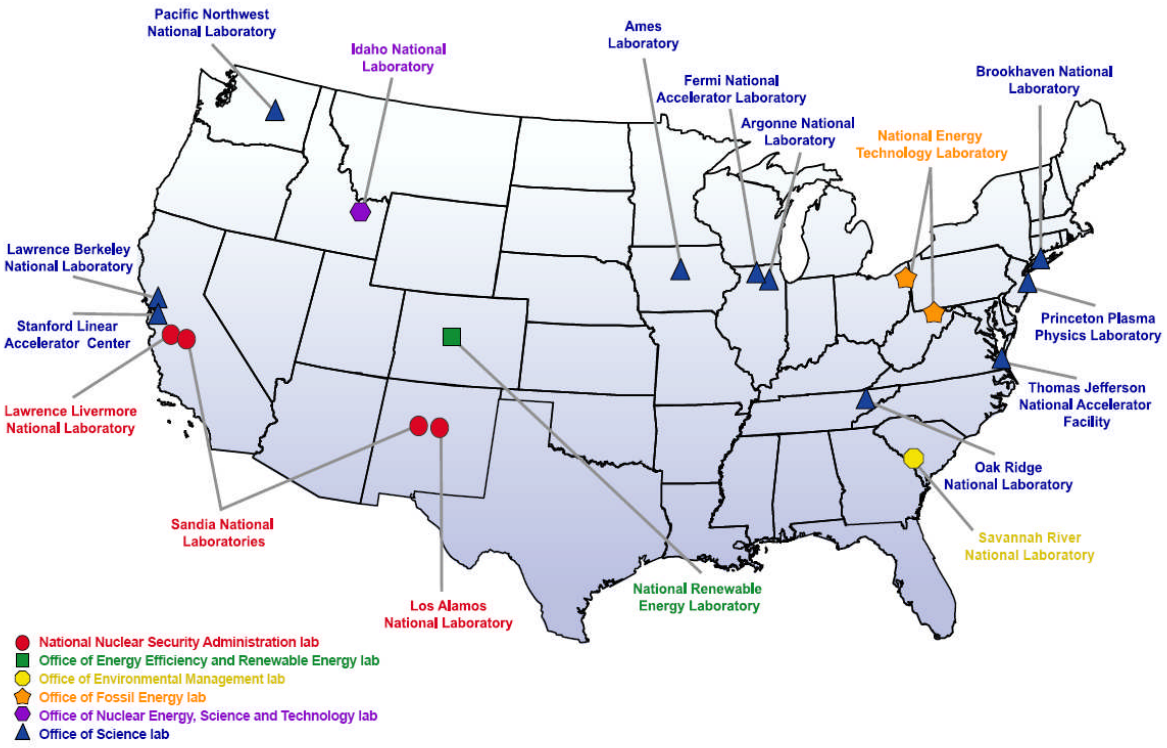
Distinctive Characteristics of
the U.S. Department of Energy's National Laboratories

What Distinguishes a DOE National Laboratory?

The U.S. Department of Energy's owns 17 national laboratories located across the country. Together, these laboratories comprise a system, unique in the world, which was created and is supported by the federal government to:

- Execute long-term government missions with substantial scientific and technological content, and often with complex security, safety, project management, or other operational challenges;
- Develop unique scientific capabilities beyond the scope of academic and industrial institutions, to broadly benefit scientific and technological communities; and
- Develop and sustain scientific and technical capabilities deemed critical by the government, and to which the government desires assured access.



A DOE national laboratory is distinguished by most, and typically all, of the following characteristics:

- ***Mission driven.*** A national laboratory provides sustained support to further one or more long-term goals in support of the Department's missions. Examples include certification of the Nation's nuclear stockpile, discovering the fundamental nature of

matter and energy, helping to assure world-wide nuclear non-proliferation, developing practical photovoltaic and other breakthrough energy-efficient technologies, strengthening the civilian nuclear energy capability, understanding the science behind the fate of subsurface contamination and global climate change.

- ***Science of scale.*** Large-scale, long-term programs make up much of the work of a national laboratory. U.S. leadership in key fields often requires a coordinated effort of substantial magnitude to overcome technical obstacles. For example, discovery of fundamental characteristics of matter typically involves teams of hundreds to thousands of researchers and budgets of up to billions of dollars over periods of many years. Similarly yet for a very different national goal, applying nanoscience to efficiently develop sustainable low-carbon fuels requires an attack by large groups of researchers over many years.

- ***Multi-disciplinary teams.*** Agency missions in general span a broad suite of scientific and technical disciplines, and national laboratories routinely deploy well-integrated interdisciplinary teams for their execution. For example, certifying the nuclear stockpile requires the insight and expertise of large numbers of physicists, materials scientists, engineers from multiple disciplines, computer scientists, and a host of others. Similarly, managing the carbon cycle will require an understanding of the earth's atmosphere and subsurface, involving investigations that engage the full spectrum of environmental sciences from climate physics to environmental microbiology and biogeochemistry working closely with computational scientists and modelers. Understanding how best to recycle nuclear fuel is another example of a challenge requiring multidisciplinary teams of chemists, chemical and nuclear engineers, materials scientists, economists, and others for solution.

- ***Distinctive, powerful research facilities.*** National laboratories are home to one or more major research facilities, and provide otherwise unaffordable experimental capabilities to the research community at large. The National Ignition Facility, the world's largest, most high-powered laser enables experiments with direct applications to stockpile stewardship, energy research, science, and astrophysics. The Spallation Neutron Source is a one-of-a-kind facility that provides the most intense pulsed neutron beams in the world for scientific research and industrial development. The High-flux solar furnace can, when required, provide flux at concentrations greater than 20,000 suns and is thus an ideal tool for testing high-temperature materials, coatings on metals and ceramics, and other materials-related applications. The DOE laboratories are home to many other "user facilities," including synchrotrons, neutron scattering facilities, accelerators for nuclear and high energy physics research, intensively instrumented, large-scale field sites for investigating the effects of clouds on atmospheric radiation, comprehensively equipped nanoscience and molecular science centers, and highest-end computing facilities. While isolated components of a facility may be found elsewhere, these facilities all have the characteristics that their assembled capability offers otherwise unattainable science. Together, DOE's laboratories provide world-class facilities where more than 30,000 scientists and engineers each year perform cutting-edge research.

- ***Safe and secure operating environments.*** National laboratories are managed to safely and securely conduct research involving special operating considerations, and may operate facilities that conduct hazardous, sensitive or classified research essential to national interests.

The presence of most if not all of these characteristics distinguish the DOE national laboratories from industrial' laboratories, which mainly pursue applied research germane to the business interests of the company, and academic laboratories, which focus largely on individual investigator research.

Managing the National Laboratories

DOE's national laboratories are "Government-Owned, Contractor-Operated" laboratories, managed under a unique legal relationship by a Management and Operating (M&O) contractor.[1] Under this management model, which had its origins in the Manhattan project and was formalized by the Atomic Energy Commission, national laboratories are owned by the federal government and operated by university, non-profit or industrial contractors. The M&O/GOCO model was specifically selected because the "arm's-length" relationship it created afforded far greater flexibility than other, more traditional contracting mechanisms. in managing scientific institutions that must be able to attract world-class scientific talent and adapt quickly to changing national research priorities and advances in science and technology. The M&O/GOCO model allows the contractors to bring the best private sector personnel and research management practices to the national laboratories, and provides the laboratories with the flexibility necessary to broadly engage academia and the private sector.

National laboratory contractors are selected competitively, under a procurement policy designed to support robust performance management, and balance DOE's interests in obtaining best value with the benefits of long-term relationships and stability for which the M&O/GOCO model was designed. The success of the M&O/GOCO model is demonstrated by the fact that the DOE laboratories, and the small number of major laboratories managed by other agencies using similar approaches, have been recognized as among the world's leading research institutions, with records of sustained scientific excellence and critical contributions to the Nation's security for as long as sixty years.

Stewardship of the National Laboratories

The DOE and its predecessor agencies have managed and operated its national laboratories to play a unique role within the national and international scientific enterprise, and as a result, these have delivered substantial value to the nation over the last six decades. To ensure the ongoing vitality of these national research laboratories, however, the DOE must exercise its stewardship responsibilities by:

[1] There is one exception to this: the National Energy Technology Laboratory, which is both government owned and operated.

- ***Ensuring a strong portfolio of laboratories***. DOE must ensure that each laboratory develop a viable and compelling long term vision and strategy, consistent with the unique characteristics of national laboratories in general, the needs of the nation broadly, and the specific strengths of the individual laboratory. Together, the laboratory system should provide the full range of capabilities needed to sustain long term national missions.

- ***Defining and awarding research programs.*** DOE Program managers must anticipate and translate administration policy and Congressional budget direction into research priorities, defining programs that take full advantage of the national laboratories, and maintain merit-based processes by which research awards are made.

- ***Building and refreshing world class capabilities.*** DOE, in concert with the broader scientific community, must ensure that distinctive and valuable research facilities are conceptualized, designed, built, updated and made available for use by government-funded researchers and the broader scientific community.

- ***Maintaining laboratory infrastructure.*** DOE must ensure that core laboratory research facilities, instrumentation and supporting infrastructure are maintained at a level consistent with forefront science and high environmental and safety standards.

- ***Reviewing and assuring management and operations performance.*** DOE must provide clear guidance on performance expectations and direct actionable performance feedback as an essential part of assuring that the management and operations of the DOE laboratories result in effective stewardship of these essential national assets, the safety and security of the people who work at them, protection of the communities in which they reside, and the appropriate protection of information and materials.

In return, the national laboratories must continue to provide the nation with a reservoir of world-class talent, facilities, and discoveries that can be focused on the missions of the Department and the needs of the Nation. Today, the laboratories are poised to play an important role in ensuring that America remains economically competitive well into the future. This combination of mission and management approach has provided the foundation for sustaining what is arguably the largest and most productive system of laboratories in the world.